ANCHOR QEA

614 Magnolia Avenue
Ocean Springs, Mississippi 39564
Phone 228.818.9626
Fax 228.818.9631

TECHNICAL MEMORANDUM

To:	Valmichael Leos, USEPA	**Date:**	July 1, 2010
From:	John Verduin, P.E.; Wendell Mears; David Keith, Anchor QEA, LLC	**Project:**	090557-01
Cc:	Philip Slowiak, International Paper; March Smith & Andrew Shafer, MIMC		
Re:	Response to TCEQ & HCPHES Comments to the Time Critical Removal Action Alternatives Analysis Memorandum San Jacinto River Waste Pits Superfund Site		

The purpose of this memorandum is to respond to the comments the United States Environmental Protection Agency (USEPA) received from the Texas Commission on Environmental Quality (TCEQ), and Harris County Public Health and Environmental Services (HCPHES) on the Time Critical Removal Action (TCRA) alternatives analysis. We feel strongly that their understanding of the engineering evaluation, and design guidance are based on flawed assumptions and interpretations about the purpose of the project. We request that you consider the technical rationale embedded in these comments as you complete your TCRA alternative evaluation and utilize it to provide the technical justification for your selection. Their comments are concentrated around five common points:

- Design storm event selection
- Dioxin contaminant transport
- Evaluation of Alternative 5
- Design standards used
- Use of hybrid alternatives

Each of these points is addressed below.

DESIGN STORM EVENT SELECTION

> *HCPHES's Comment 1: As we stated in our letter to you dated May 17, 2010 on the initial, preliminary Time Critical Removal Actions (TCRA), we note that standard design practices require structures whose failure would adversely affect human health or the environment to be built so as not to be adversely impacted by a 100-year flood event. We urge at this point that the EPA require the design criteria of the time critical containment be set at a 100-year flood event (1 %) at a minimum or higher. The design should take into consideration both the water surface elevation and river's flow velocity for that design event. The 100-year (1 %) floodplain elevation in the area of this Site ranges from under 13 feet to almost 14 feet (NA VD 1988). See attached portions of the current FEMA Flood Insurance Rate Map (FIRM) for reference. The current draft analysis under review proposes to design to the 10-year flood event. Please be aware that there have been 3 flood and storm surge events in this watershed in the past 30 years that have exceeded or were near the 100-year flood level (Hurricanes Alicia and Ike, and the flood of October 1994), and the current hurricane season is projected to be worse than average. When the storm surge probability is factored into flooding events, the actual flood event probability is greater (more severe). We again urge, for the sake of human health and the environment, that this time critical removal action be designed to meet or exceed 100-year flood elevation and velocity.*

The respective commenter's have confused the terms and factors behind determining a design storm event, specifically the terms Tropical Storm Events (TSEs), Flood Flow Events (FFEs), and FEMA Flood Insurance Rate Maps (FIRM). In determining the design event, the critical piece of information is the force required to move the material off site, which is a function of water flow velocity and bed shear stress. Flood flow events do not necessarily always translate into high velocity events at the sediment water interface. While Tropical Storm Allison, and Hurricanes Katrina, Ike, and Alicia caused flooding indicative of the FEMA FIRMs provided, they did not produce erosive velocities and bed shear forces in the upper spectra of the tidal plane beyond the 10-year FFE. That is because the high river stage which contributed to flooding was the result of a tropical storm surge, which actually creates velocity vectors that diminish or neutralize the velocity of the river flows.

For instance, Hurricane Ike reached shore as a category 3 (Saffir-Simpson Scale) storm. The tidal surge was approximately 10- feet at the Morgan's Point NOAA gauge. The tidal forces of the storm surge offset the forces of stormwater runoff because the head differential between upstream and downstream areas of the system is not as pronounced as a pure flood event. Table 1 summarizes the flood stage elevations and stage differential between upstream and downstream areas in the San Jacinto River basin, and shows that the stage differences between upstream and downstream areas that would drive flow velocity and bed shear are relatively minor in tropical storm events, compared to a pure runoff flow event such as the 1994 flood. For example, the bed shear velocities during Ike were less than the 10-year flow event.

Tropical Storm Allison that flooded downtown Houston with stage heights approaching the October 1994 FFE in White Oak and Brays Bayous, had similar bed shear forces (less than a 10-year FFE) on the site because of the storm surge associated with that event. Conversely, the October 1994 flood was a result of a non-tropical storm crossing the U.S. from the Pacific coast that dropped 30 inches of rainfall over 38 Texas counties, including the San Jacinto River Basin, without an associated tropical depression storm surge. For this storm, USGS reported stages and flows met or exceeded the 100-year flood event.

In summary, stage height does not directly correlate to the erosive forces necessary to move material from the site. Basing the design on FFEs as we have done provides a conservative estimate of the bed shear stress predictions, resulting in an over-protective design. The table below shows the corresponding flows (cubic feet per second) for the respective events cited. The Anchor QEA team is utilizing hydrodynamic models and considers the combined effects of upstream flows and the ebb tidal bay below.

Table 1

Stage Heights and Flow Rates for Referenced TSEs and FFEs

Event	Flow (cfs)	Upstream Stage Height (ft MSL)	Downstream Stage Height (ft MSL)	Upstream to Downstream Stage Difference (ft)
Hurricane Alicia (1983)*	37,000	11.9	10.0	1.9
Hurricane Ike (2008)	63,100	12.1	9.8	2.3
Tropical Storm Allison (2001)	104,674	3.0	3.6	-0.7
10-year	126,000	6.9	2.3	4.6
25-year	202,000	11.5	2.3	9.2
October 1994 Flood	344,348	25.6	2.3	23.3

*Estimated

TCEQ Comment 2: Primarily, the intent to use the 10-year storm event as the design storm event for this site may be unacceptable. The recent 10-year history for major storm events experienced in this area include Tropical Storm Allison (June 2001), Hurricane Katrina (Sept. 2005), and Hurricane Ike (Sept. 2008). Each of these storms was considered a 100-year storm event. The 100-year storm event is routinely used for design criteria for projects in the Houston region to optimize protection of human health and the environment. The TCEQ recommends the use of the 100-year storm event.

Reference Appendix A of the TCRA Alternatives Analysis Memorandum dated June 14, 2010 and its cumulative references.

Following USEPA guidance, a permanent remedy would be designed to resist a flow event with a return-period of 100-years. The risk of a 100-year storm occurring in the 2- to 7-year time period is **2 to 6.8 percent**. Given the low probability of this occurring, sizing materials to resist this event would be impractical for the short timeframe that the TCRA is expected to be in place. Therefore, the TCRA design is based on a 10-year FFE. In addition, if a rare, extreme event did occur in the short timeframe, the disruption to the cover system could be easily observed and repaired.

Table 2 presents the probability of occurrence of 2-, 5-, 10-, and 25-year storm events to occur within the two and seven year period. As an example from Table 2, a 5-year flow event has an annual probability of occurring in any given year of 20 percent. The 5-year event would have a 36 percent chance of occurring during a 2-year wait period and a 79 percent chance during a 7-year wait period.

Table 2
Percent Chance of Occurrence

Return Period (years)	Annual Percent Chance of Occurrence (percent)	Period of Concern (years)	
		2	7
2	50	75	99
5	20	36	79
10	10	19	52
25	4	8	25

As discussed in Appendix A of the TCRA Alternatives Analysis Memorandum, USEPA guidance recommends designing permanent engineered caps for a 100-year flow event. Over a 100-year design life, the percent chance of a 100-year flow event occurring is approximately 63 percent. For a temporary two- to seven- year TCRA, a flow event with an equivalent chance of occurring during a two to seven year period of approximately 63 percent would correspond to a 2- to 10-year storm event. Therefore, we continue to recommend that the TCRA will be designed to resist 10-year return-interval flow events in the San Jacinto River because of the overall short-term duration of proposed project and the requirement for consistency with a final remedial design.

DIOXIN CONTAMINANT TRANSPORT

HCPHES Comment 2: Transport of dioxin contamination on colloid particles does not seem to be a consideration in the design alternative analysis. This is indicated by the proposal of use of weep holes in the sheet piling and use of geotextiles under aggregate. Through conversations with scientists associated with this effort on dioxin transport, we believe that attention to transport of dioxin on colloid particles is an important transport mechanism to consider in containment alternative *considerations. Of the alternatives presented, Alternative 5 would have the best opportunity to contain dioxins moving in colloid particles.*

Dioxins/furans strongly adsorb to soil particles and are believed to be virtually immobile in the subsurface (Fan et. al. 2006; USAF 2006; ATSDR 1998). ATSDR (1998) indicates that chlorinated dibenzo-p-dioxins (CDDs) "…bind strongly to the soil, and therefore are not likely to contaminate groundwater…" and "CDDs are unlikely to leach to underlying groundwater…" Colloid particles are generally very small particulate matter or organic ligands that can be theoretically transported in porous media through large pore spaces and relatively high groundwater flow environments. Groundwater flow at the site is minimal because of the very flat gradient across the shallow groundwater table and the low permeability of underlying and intermixed clays. In addition, the pulp and paper waste is clay like material with very low permeability that would limit groundwater flow velocities and potential colloid transport pathways.

To control the movement of dioxin, the solids, including very fine grained colloidal particles, need to be controlled both during construction and during the short time period the TCRA exists. All of the alternatives provide a cover over the sediments that are designed to resist erosion and resuspension of the sediments by mechanical resuspension and transport.

The sheet pile walls require weep holes to reduce unbalanced hydrostatic pressures, or a much stronger (and much more expensive) sheet pile wall will be required. Therefore, Alternatives 1 and 2 allow flow into and out of the enclosed sheet pile wall. It should be noted however, that the sediments within the sheet pile wall are confined with a granular cover.

The granular cover will have a gradation that will filter out and minimize the flow of solids and these types of covers are commonly used on contaminated sediment sites for a variety of contaminants, including dioxins and furans. The granular cover will be placed in a manner to minimize disturbance of sediments during construction and will include a geotextile fabric to limit the resuspension of fine grained sediments and colloids. A properly designed geotextile base serves as an extra layer of protection in a granular cover system and provides an effective means of filtering of solids, including colloids.

The shell of an articulated concrete block mat (ACBM), prior to being filled with grout is a geotextile. So the ACBM is very similar to a geotextile or a granular cover with all three having the same capacity to contain solids; however, the ACBM has a distinct disadvantage over the granular cover when one considers the potential final remedy implementation for the Site. Removal of ACBM would include mechanical demolition of concrete and cable blocks – the equipment required for the demolition and removal of ACBM would provide a much greater risk of particulate and colloid release to the water column, compared to a more natural granular cover.

EVALUATION OF ALTERNATIVE 5

HCPHES Comment 3: The Effectiveness Summary in Section 6.1.6 contains undue selectiveness and preferences toward a specific' alternative. Also, this section is inconsistent in consideration of other statements contained in the analysis. The first bullet "Isolating target sediments: All alternatives rank equally"; is incorrect when considering colloid sized contaminants where Alternative 5 would be best and Alternatives 1 and 2 with weep holes in the sheet piling would be least protective in target sediments. The second bullet states: "Withstanding extreme weather events: All alternatives rank equally"; however, considering the constructed nature of Alternative 5, this containment would have an advantage over the others. The third bullet states "Preventing benthic and human contact: All alternatives rank equally"; but by the shear solid nature of the ACBM, Alternative 5 would have an advantage over the others. The fourth bullet concerning impacts during construction ranks Alternative 5 as highest. The final bullet states "Compatibility with future Actions at the site: Alternative 3 ranks highest. Alternative 4 ranks slightly lower"; note however that in Section 6.1.5.2, Alternative 5 ranks moderate to high, and third among the five alternatives.

Based on the evaluation criteria provided in Section 2, Alternative 5 is the preferred alternative of those presented for the following reasons:

- *Alternative 5 is superior in effectiveness over the other alternatives in preventing erosion of the sediments especially when considering movement of contaminants as colloids and by advective and diffusive loss of pore water, and is superior in preventing benthic and human contact.*

- *Alternative 5 is superior over the other alternatives in withstanding the design storm event and losses related to boat navigation due to the solid nature of the ACBM, with rock scour apron protection.*
- *Alternative 5 has the least disturbance potential during construction (see Table 2)*
- *Alternative 5 ranks high to moderate for compatibility with future containment activities (see Section 6.1.5.2).*
- *Alternative 5 has the fewest potential impacts to navigation and flood flow due to its lower profile and hard substrate (see Table 4).*
- *Alternative 5 is tied with Alternative 4 on the least time of completion at 2 to 3 months (see Table 4).*
- *As discussed in the description for Alternative 5, four data gaps were identified for design of the TCRA: While this is number ties Alternative 2 and exceeds those of the other three, filling these data gaps will enable a superior alternative.*
- *With a cost estimate variability of +/- 30 percent, all five alternatives could potentially have the same cost. It is also not clear what the basis is of the +/- 30 % variability.*

All the alternatives were evaluated following CERCLA guidance (USEPA 1988) and using existing site data, talking with local contractors, and using engineering judgment. HCPHES is making the assumption that granular caps are not as protective as the ACBM. A number of relevant guidance documents published by USEPA and USACE for the selection and design of granular covers were followed:

- Contaminated Sediment Remediation Guidance for Hazardous Waste Sites, USEPA, December 2005
- USEPA Guidance for In-Situ Subaqueous Capping of Contaminated Sediments (ARCS Program), Palermo et al., 1998
- Guidance for Subaqueous Dredge Material Capping, USACE, June 1998

<u>**Alternative 5 is not more protective than the other alternatives**</u>, this alternative will likely be:

- Very difficult to incorporate into the NTCRA or final remedy.

- Significantly more expensive (20 to 90 percent) than the other alternatives.
- The final product would be a hard substrate that would inhibit re-colonization and habitat utilization by benthos or other aquatic species. It is interesting to note that NOAA and other agencies have very negative perceptions about the large scale use of ACBM in contaminated sediment site remedies. These perceptions are primarily based on the fact that the final product is a completely unnatural barrier to normal ecological functions, whereas granular caps offer some ecological value.
- Difficult to repair or remove, causing greater disturbances and potential release and off-site transport of contaminants.

Table 3 presents a specific response to each of HCPHES' bulleted items.

DESIGN STANDARDS USED

TCEQ Comment 1: Based on the brief review time period allowed for comments, the alternatives analysis presented in the proposed Draft TCRA does not appear to meet the design criteria which the TCEQ typically requires of the state contractors as well as the regulated community.

The design criteria followed were those outlined in CERCLA guidance (USEPA 1998) and required in the Action Memorandum (USEPA 2010, Appendix A).

USE OF HYBRID ALTERNATIVES

TCEQ Comment 3: Regarding the analysis of the proposed alternatives, it is noted that there were no alternatives that proposed using more than one technology (e.g., removal, containment, or treatment). The TCEQ did not see any alternatives that used a combination of the technologies presented in the Draft TCRA, such as containment with removal.

All of the alternatives considered are a "hybrids", involving multiple technologies:

a. Alternative 1 – sheet piling and granular cover
b. Alternative 2 – sheet piling, dredging, geotube dewatering, and granular cover
c. Alternative 3 – granular cover and revetment
d. Alternative 4 – rock berm, granular cover, and revetment
e. Alternative 5 – ACBM, dredging, and geotube dewatering

REFERENCES

ATSDR, 1998. Toxicological Profile for Chlorinated Dibenzo-*p*-Dioxins. Draft Report. U.S. Department of Health and Human Services, Public Health Service, Agency for Toxic Substances and Disease Registry, Atlanta, GA.

Fan et al., 2006. Fate and Transport of 1278-TCC, 1378-TCDD, and 1478-TCDD in Soil-Water Systems. Science of the Total Environment 371 (2006) 323-333.

Palermo, M., Maynord, S., Miller, J., and Reible, D., 1998. *Guidance for In-Situ Subaqueous Capping of Contaminated Sediments,* EPA 905-B96-004, Great Lakes National Program Office, Chicago, IL.

USAF, 2006. Remedial Investigation Report, Bellows Hardfill (LF23) Bellows Air Force Station, Oahu, Hawaii. April 2006

USEPA 1988. Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA.

USEPA, 2005. Contaminated Sediment Remediation Guidance for Hazardous Waste Sites. EPA-540-R-05-012. December, 2005.

USACE, 2008b. Technical Guidelines for Environmental Dredging of Contaminated Sediments. ERDC/TL TR-08-29. U.S. Army Corps of Engineers, Engineer Research and Development Center (ERDC), Environmental Laboratory. September 2008.

USEPA, 2010. Administrative Settlement Agreement and Order on Consent for Removal Action. U.S. EPA Region 6 CERCLA Docket No. 06-03-10. In the matter of: San Jacinto River Waste Pits Superfund Site Pasadena, Harris County, Texas. International Paper Company, Inc. & McGinnes Industrial Management Corporation, respondents.

Table 3

Evaluation of Alternative 5

HCPHES Assessment	Anchor QEA Assessment
Alternative 5 is superior in effectiveness over the other alternatives in preventing erosion of the sediments especially when considering movement of contaminants as colloids and by advective and diffusive loss of pore water, and is superior in preventing benthic and human contact.	**All of the alternatives can be designed to resist erosion.** Granular covers will be designed following accepted USEPA and USACE guidance documents (Palermo 1998; USACE 1998). **Colloids will only move from the sediments into the granular cover under advective flow**—diffusive flow will not move colloids. The advective flow at the site is minimal because of the very flat gradient across the shallow groundwater table and the low permeability of the underlying and intermixed clays. In addition, the TCRA will only be in service for 2 to 7 years before the NTCRA or final remedy is implemented. Colloid transport would likely not exit a granular cap even with measurable advective flow due to the short life of the TCRA. From the RI/FS Work Plan: "Although available surface water data are limited, current concentrations of COPCs in surface water within the Site are comparable to those at upstream locations (Section 2.3.4). In addition to analysis of sediment and tissue data from the Site, chemical fate and transport models and other Site-specific data may be used with partitioning parameters to predict dissolved concentrations of COPCs in surface water, and may also be addressed in this manner for pore water." **Alternative 5 is equivalent (not superior)** to the other alternatives with respect to preventing erosion of the underlying sediments, and preventing benthic and human contact.
Alternative 5 is superior over the other alternatives in withstanding the design storm event and losses related to boat navigation due to the solid nature of the ACBM, with rock scour apron protection.	**All of the alternatives can be designed to resist the design storm event.** Granular covers will be designed following accepted USEPA and USACE guidance (Palermo 1998; USACE 1998). Alternative 5 is equivalent (not superior) to the other alternatives with respect to resisting the design storm event. Experience with ACBM indicates they will not deform to impact loads from barges and debris. A designed granular fill will deform and absorb the blow instead of breaking the integrity of a rigid structure.

Alternative 5 has the least disturbance potential during construction (see Table 2)	**Agreed. There is a potential for dredging-related water quality impacts.**
Alternative 5 ranks high to moderate for compatibility with future containment activities (see Section 6.1.5.2).	**Alternative 5 has the lowest compatibility for NTCRA or final remedy alternatives that include dredging or treatment (see Table 3).** The ACBM will have to be demolished with heavy equipment into manageable pieces and removed from site. The estimated weight of the material is 10,000 to 12,000 tons. This will cause significant disturbance to the underlying sediments potentially causing water quality impacts and worker exposure. The ACBM may be more compatible with in situ containment NTCRA or final remedy alternatives, however; it is anticipated that some demolition and removal will likely be required to tie in a containment system alternative. **Alternative 5 is a hard substrate and resistant to recolonization and less ecological value that a granular cover.** Recolonization and ecological use is more likely to occur on a granular cover versus the ACBM. **Alternative 5 would provide an attractive nuisance to continued wade fishing along the east cell.**
Alternative 5 has the fewest potential impacts to navigation and flood flow due to its lower profile and hard substrate (see Table 4).	**Agreed**
Alternative 5 is tied with Alternative 4 on the least time of completion at 2 to 3 months (see Table 4).	**Agreed that Alternatives 3, 4 and 5 have similar construction periods.**
As discussed in the description for Alternative 5, four data gaps were identified for design of the TCRA: While this is number ties Alternative 2 and exceeds those of the other three, filling these data gaps will enable a superior alternative.	**Agreed that the number of data gaps are similar to Alternative 2.**
With a cost estimate variability of +/- 30 percent, all five alternatives could potentially have the same cost. It is also not clear what the basis is of the +/- 30 % variability.	**CERCLA guidance (USEPA 1988) recommends cost estimate have an accuracy of within +50 to -30 percent**. Based on discussions with USEPA (May 13, 2010 coordination meeting), a tighter cost estimate was developed. All of the cost estimates have a contingency of 30 percent included, representative of the conceptual level design for each alternative. The contingency accounts for potential changes in quantities and unforeseen conditions that could occur during final design or construction. Alternative 5 is almost twice as expensive as Alternative 3 and 20 percent more expensive then the next lowest cost alternative.